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Liwen He

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NIXON & VANDERHYE, PC
901 NORTH GLEBE ROAD, 11TH FLOOR
ARLINGTON, VA 22203

EXAMINER

FERNANDEZ RIVAS, OMAR F

ART UNIT

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

**Supplemental
Notice of Allowability**

Application No.

10/507,112

Examiner

OMAR F. FERNANDEZ RIVAS

Applicant(s)

HE, LIWEN

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 3/13/2009.
2. ☒ The allowed claim(s) is/are original 1,3-21 and 23-25.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some* c) ☐ None of the:
- ☒ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
- * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____. |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____. |

SUPPLEMENTAL EXAMINER'S AMENDMENT

1. This supplemental amendment has been made to correct errors in the Examiner's Amendment made on 5/28/2009. The errors were typographical errors made by the Examiner and were pointed out to the Examiner by the Applicant on Wednesday, July 08, 2009.
2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Chris Comuntzis on May 13, 2009.

The Examiner has made the following changes to the claims. Additions to the claims are reflected by underline (example) and deletions are reflected by strikethrough (~~example~~).

Claim 1

An automated computerized method for optimizing allocation of a set W of n tasks to m available resources for accomplishing such tasks using combinatorial multimodal optimization for finding multiple optimal ways of dividing said set W of n tasks ~~task values~~ into m respective groups associated with said available resources, such that each of the groups satisfies a respective constraint condition, said method comprising:

using at least one computer to execute a computer program to automatically perform a series of machine operations comprising:

(a) receiving digital data signals representing plural tasks for assignment to said available resources and, based thereon, defining an initial population of trial solutions representing multiple optional ways of dividing the set W of n tasks between said m ~~assigning specific tasks to specific~~ resources;

(b) calculating for each trial solution a fitness vector comprising m elements, each of which is indicative of whether the constraint condition of a corresponding respective one of the m groups has been satisfied by the trial solution;

(c) selecting a plurality of trial solutions for a next generation in dependence upon their respective fitness vectors;

(d) creating a new population of trial solutions including the selected earlier trial solutions;

(e) repeating steps (b) to (d) until the population of trial solutions stabilizes, the individual trial solutions of the stable population representing multiple optional ways of dividing the set W of n tasks to said m resources; and

(f) outputting data representing at least one of the individual trial solutions of said stabilized population as an optimized allocation of tasks to resources.

Claim 14

An automated computerized method of distributing a plurality of tasks between a plurality of devices connected together to form a network, wherein each device has an

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associated constraint on the amount of tasks that it can perform per unit of time, said method comprising:

using at least one computer to execute a computer program to automatically perform a series of machine operations comprising:

(a) generating a plurality of trial solutions representing multiple allocations of tasks to devices to form an initial population of allocations;

(b) calculating for each trial solution a fitness vector comprising a plurality of elements each of which is indicative of whether the associated constraint of with a corresponding respective one of the plurality of devices and is indicative of whether the constraint associated with that corresponding respective device has been satisfied by the trial solution independently of the extent to which the constraints associated with the other devices have been satisfied by the trial solution;

(c) selecting a plurality of allocations of tasks to devices for inclusion in a next generation of allocations in dependence upon their respective fitness vectors;

(d) creating the next generation of allocations of tasks to devices by including the allocations selected in step (c) together with new allocations, each of which is formed from a combination of two or more of the allocations selected in step (c);

(e) repeating steps (b) to (d) until the population stabilizes; and

(f) outputting data representing an allocation of the tasks among the devices according to one of the allocations included in the stabilized population.

Claim 21

A ~~tangible medium~~ computer readable medium containing a computer program which, when executed effects a method for optimizing allocation of a set W of n tasks to m available resources for accomplishing such tasks using combinatorial multimodal optimization for finding multiple optimal ways of dividing said set W of n tasks into m resource groups, such that each of the groups satisfies a respective constraint condition, said method comprising:

using at least one computer to execute a computer program to automatically perform a series of machine operations comprising:

(a) defining an initial population of trial solutions representing multiple optional ways of dividing the set W of n tasks between said m resources;

(b) calculating for each trial solution a fitness vector comprising m elements, each of which is indicative of whether the constraint condition of a corresponding respective one of the m groups has been satisfied by the trial solution;

(c) selecting a plurality of trial solutions for a next generation in dependence upon their respective fitness vectors;

(d) creating a new population of trial solutions including the selected earlier trial solutions;

(e) repeating steps (b) to (d) until the population of trial solutions stabilizes, the individual trial solution of the stable population representing multiple optional ways of dividing the set W of n tasks between said m resources; and

(f) outputting data representing at least one of said stabilized population as an optimized allocation of tasks to resources.

Claim 23

A system comprising a plurality of devices connected together to form a network, wherein each device has an associated constraint on the amount of tasks that it can perform per unit of time, the system including an allocation subsystem for allocating a plurality of tasks among the devices, the allocation subsystem comprising:

(a) means for generating a plurality of trial solution allocations representing multiple allocations of tasks among the devices to form an initial population of allocations;

(b) means for calculating for each trial solution allocation a fitness vector comprising a plurality of elements each of which is ~~indicative of whether the associated constraint of~~ with a corresponding respective one of the plurality of devices and is indicative of whether the constraint associated with that corresponding respective device has been satisfied by the trial solution independently of the extent to which the constraints associated with the other devices have been satisfied by the trial solution;

(c) means for selecting a plurality of allocations for inclusion in a next generation of allocations in dependence upon their respective fitness vectors;

(d) means for creating the next generation of allocations by including the allocations selected in step (c) together with new allocations each of which is formed from a combination of two or more of the allocations selected in step (c);

e) means for repeating steps (b) to (d) until the population stabilizes; and

(f) means for outputting an allocation of the tasks among the devices according to one of the allocations included in the stabilized population.

Claim 24

A method of operating a multi-processor computer system to execute a computer program including a set of multiple separate tasks which must all be completed in order for the program execution to be complete, said method comprising:

distributing multiple of said set of program tasks between multiple computer program processor devices to efficiently accomplish all such distributed tasks wherein each computer program processor device has an associated constraint on the amount of tasks that it can perform per unit of time, said distribution of tasks to said processor devices being accomplished by:

(a) receiving digital data signals representing a set of plural tasks for assignment to available processor devices and, based thereon, defining an initial population of trial solutions representing multiple optional ways of dividing the set of tasks between said ~~assigning specific tasks to specific~~ processor devices;

(b) calculating for each trial solution a fitness vector comprising a plurality of elements each of which is ~~indicative of whether the constraint of~~ associated with a corresponding respective one of the multiple computer program processor devices and is indicative of whether the constraint associated with that corresponding respective computer program processor device has been satisfied by the trial solution

independently of the extent to which the constraint associated with the other computer program processor devices have been satisfied by the trial solution;

(c) selecting a plurality of trial solutions for a next generation in dependence upon their respective fitness vectors;

(d) creating a new population of trial solutions including the selected earlier trial solutions;

(e) repeating steps (b) to (d) until the population of trial solutions stabilizes, the individual trial solutions of the stable population representing multiple optional ways of dividing the input set of tasks; and

(f) outputting task assignments to said processor devices in conformance with at least one of said stabilized population as an optimized allocation of tasks to resources.

Claim 25

A multi-processor computer system for executing a computer program including a set of multiple separate tasks which must all be completed in order for the program execution to be complete, said system comprising:

a plurality of computer program processors; and

means networked with said multiple computer program processors for distributing multiple of said set of program tasks between said multiple computer program processor devices to efficiently accomplish all such distributed tasks wherein each computer program processor device has an associated constraint on the amount of

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tasks that it can perform per unit of time, said distribution of tasks to said processor devices being accomplished by:

(a) receiving digital data signals representing a set of plural tasks for assignment to available processors and, based thereon, defining an initial population of trial solutions representing multiple optional ways of dividing the set of tasks between said ~~assigning specific tasks to specific~~ processors;

(b) calculating for each trial solution a fitness vector comprising a plurality of elements each of which is ~~indicative of whether the constraint of~~ associated with a corresponding respective one of the multiple computer program processor devices and is indicative of whether the constraint associated with that corresponding computer program processor device has been satisfied by the trial solution independently of the extent to which the constraints associated with the other computer program processor devices have been satisfied by the trial solution;

(c) selecting a plurality of trial solutions for a next generation in dependence upon their respective fitness vectors;

(d) creating a new population of trial solutions including the selected earlier trial solutions;

(e) repeating steps (b) to (d) until the population of trial solutions stabilizes, the individual trial solutions of the stable population representing multiple optional ways of dividing the input set of tasks, and

(f) outputting task assignments to said processors in conformance with at least one of said stabilized population as an optimized allocation of tasks to resources.

Reasons for Allowance

3. The following is an examiner's statement of reasons for allowance: claims 1, 3-21 and 23-25 are considered allowable since when reading the claims in light of the specification, as per MPEP § 2111.01, In re Donaldson Co., Inc., 29 USPQ 2d 1845, 1850 (Fed. Cir. 1994), none of the references of record alone or in combination disclose or suggest the combination of limitations specified in the independent claims; specifically calculating for each trial solution a fitness vector comprising m elements (note that m has been previously defined as to be the number of available resources which is the same as the number of groups associated to those resources and further defined at e.g. pg. 8, line 26 to pg. 9, L14; pg. 9, L23 to pg. 12, L19 of the specification of the instant application) as recited in claims 1 and 21 and calculating for each trial solution a fitness vector comprising a plurality of elements each of which is associated with a corresponding respective one of a plurality of devices/computer program processor devices as recited in claims 14 and 23-25 (as defined at e.g. pg. 8, line 26 to pg. 9, L14; pg. 9, L23 to pg. 12, L19 of the specification of the instant application).

Corne et al. (PCT #WO 02/03716 A1) discloses multi-objective optimization. A plurality of solutions is generated and modified to generate a second solution. Based on a the cost value for each solution is evaluated against a target cost value to determine the optimum configuration parameters for the solutions. These steps are iterated for a predetermined number of times.

Buczak (US Patent #6,957,200) discloses selecting sensors from a sensor network. Individuals representing sensors for a genetic algorithm are determined. A fitness function is defined for each individual. Genetic operations are performed on the individuals based on the fitness function and offsprings are created from the individuals.

Corne and Buczak do not teach the combination of limitations recited in independent claims 1, 14, 21 and 23-25, and especially the limitations set forth above. The combination of Corne and Buczack or any of the prior art of record fails to teach the combination of limitations recited in the independent claims without unduly motivating one of ordinary skill in the art to exert substantial experimental effort to integrate such combination concepts. Further to the Examiner's Amendment cited above, the Applicant's Remarks in the response dated 3/13/2009 are acknowledged and accepted, specifically:

"First, the term "groups" is defined (and therefore limited) in multiple elements including the preamble of the relevant claims. For example, the amended preamble of claim 1 specifies a "method for optimizing the allocation of a set Wof n tasks to m available resources for accomplishing such tasks using combinatorial multimodal optimization for finding multiple optimal ways of dividing said set Wof n tasks into m respective groups associated with said resources" and the amended preamble of claim 21 specifies substantially the same method. This makes it clear that there are to be as many groups as there are resources (in particular m of each) and that each group is associated with a particular resource (hence the modifier "respective"). This is a clear limitation on the meaning of the term "groups" which appears in these claims".

The claim term "groups" is further defined and hence limited at step (b) of amended claims 1 and 21 "calculating for each trial solution a fitness vector comprising m elements, each of which is indicative of whether the constraint condition of a corresponding respective one of the m groups has been satisfied by the trial solution." Use of the word "the" preceding the claim term "groups" makes clear that Applicant is referring back to the "groups" referred to in the preamble of the claims, as discussed above. Furthermore, it is clear that there are m groups where m is the number of resources and it follows that there is a corresponding group for every resource and there are m of each, i.e., m resources and m groups with each group corresponding to a respective resource. Once an optimized solution has been found, each group of tasks will be assigned to its corresponding resource". As stated in page 16 of the remarks.

"The above arguments have been specifically addressed to independent claims 1 and 21 which expressly recite the claim term "groups." However, the same arguments are applicable to amended independent claims 14 and 23-25 which require "... elements each of which is associated with a corresponding respective one of the [plurality of devices or multiple computer processor devices] and is indicative of whether the constraint associated with that corresponding [device or multiple computer processor device] has been satisfied by the trial solution..." This requires a one to one correspondence between elements of the vector and resources (i.e., a given element must be associated with a single resource and not with multiple different resources as in Corne) where the "resource" in question depends upon the particular claim (e.g., in claims 14 and 23 its "devices" in claims 24 and 25 its "processor devices"). Thus,

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Applicant's inventions clearly distinguished over Corne since in Corne each element is associated not with a single link, but with all of the links. Instead in Corne, each element is associated with a certain type of constraint which is applicable to all of the links and then the individual extents to which that type of constraint is satisfied for every link are summed together to generate an overall extent to which that type of constraint is satisfied by the system as a whole.

In summary, Corne does not teach or suggest "... elements each of which is associated with a corresponding respective one of the [plurality of devices or multiple computer processor devices] and is indicative of whether the constraint associated with that corresponding [device or multiple computer processor device] has been satisfied by the trial solution" as required by amended independent claims 14 and 23-35. Rather, each element in Corne is indicative of the global extent to which a particular global objective function has been met. Thus the same arguments apply for independent claims 14 and 23-25 as for independent claims 1 and 21". As stated in pages 18-19 of the remarks.

A practical application for the claimed invention has been disclosed at e.g. page 1, lines 3-23 of the specification of the instant application.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

4. Claims 1, 3-21 and 23-25 are allowed.

Correspondence Information

5. Any inquiries concerning this communication or earlier communications from the examiner should be directed to Omar F. Fernández Rivas, who may be reached Monday through Friday, between 8:00 a.m. and 5:00 p.m. EST. or via telephone at (571) 272-2589 or email omar.fernandezrivas@uspto.gov.

If you need to send an Official facsimile transmission, please send it to (571) 273-8300.

If attempts to reach the examiner are unsuccessful the Examiner's Supervisor, David Vincent, may be reached at (571) 272-3080.

Hand-delivered responses should be delivered to the Receptionist @ (Customer Service Window Randolph Building 401 Dulany Street Alexandria, VA 22313), located on the first floor of the south side of the Randolph Building.

Omar F. Fernández Rivas
Patent Examiner
Artificial Intelligence Art Unit 2129
United States Department of Commerce
Patent & Trademark Office

/Omar F. Fernández Rivas/
Examiner, Art Unit 2129
/David R Vincent/
Supervisory Patent Examiner, Art Unit 2129